Rejection Under 35 U.S.C. §103

A. Takahashi, Chambers, Zeman, Zhang and Doushita

The Office Action rejects claims 1-13 and 20 under 35 U.S.C. §103(a) over Takahashi et al., ("Photocatalytic properties of TiO_2/WO_3 bilayers ..." 2003) ("Takahashi") in view of Chambers et al. ("Epitaxial growth and properties of ferromagnetic co-doped TiO2 anatase," 2001) ("Chambers"), Zeman et al. ("Nano-scaled photocatalytic TiO_2 ..." 2003) ("Zeman"), Zhang et al. ("Surface modification of TiO_2 film by iron doping ..." 2003) ("Zhang") and U.S. Patent No. 6,576,344 to Doushita et al. ("Doushita"). Applicants respectfully traverse the rejection.

Claim 1 recites "[a] structure, comprising: a substrate; and an antisoiling layer having a photocatalytic property formed on at least part of a surface of the substrate; wherein: the antisoiling layer comprises a titanium dioxide-based layer and an underlayer (UL) immediately beneath the titanium dioxide-based layer; the titanium dioxide–based layer comprises titanium oxide at least partly crystallized in anatase form; the underlayer (UL) has a crystallographic structure that assisted in crystallization of the titanium oxide, by heteroepitaxial growth in the anatase form, of the titanium oxide-based layer; and the photocatalytic property is obtained without performing a heating step" (emphasis added). Takahashi, Chambers, Zeman, Zhang and Doushita do not disclose or suggest such a structure.

As discussed above, the structure of claim 1 requires a substrate, an underlayer and a TiO_2-based layer. The TiO_2-based layer is at least partially crystallized in anatase form. The formation of anatase TiO_2 generally depends on the application of a thermal treatment, either before or after deposition of the titanium dioxide-based layer. Deposition of a TiO_2-based layer at room temperature, as takes place in Takahashi (*see* page 1410, left column), results in

formation of an amorphous coatings, unless a specific sub-coating, such as the underlayer recited in claim 1, is used.

Because, in Takahashi, a titanium dioxide-based layer is deposited at room temperature, and a sub-coating that promotes the growth of an anatase titanium dioxide-based layer by heteroepitaxial phenomena is not employed (WO_3 does not promote heteroepitaxial growth), the method of Takahashi does not yield anatase TiO_2. That is, the structure of Takahashi does not include: (i) a TiO_2-based layer, or (ii) an underlayer (UL) that assists in heteroepitaxial growth of anatase TiO_2. Claim 1 requires only a substrate and two additional layers – Takahashi does not disclose either of the two additional layers.

The Office Action asserts that it would have been obvious to replace the WO_3 layer of Takahashi with the $SrTiO_3$ layer of Chambers. *See* Office Action, page 7. In Chambers, anatase cobalt-doped TiO_2 is formed on an $SrTiO_3$ substrate. *See* Chambers, page 3467. That is, $SrTiO_3$ is not an underlayer, but a substrate, so Chambers does not include a substrate, an underlayer and an anatase TiO_2-based layer. Accordingly, if a skilled artisan were to replace any layer of Takahashi with the $SrTiO_3$ layer of Chambers, it would be the substrate of Takahashi. Regardless of whether the substrate or both the substrate and the WO_3 layer of Takahashi were replaced with the $SrTiO_3$ layer of Chambers, the resulting composite structure would not include a substrate, an underlayer that assists in heteroepitaxial growth of anatase TiO_2, and a TiO_2-based layer. That is, the structure yielded by combining the teachings of Takahashi and Chambers would not have each of the features recited in claim 1.

Further, the cobalt-doped TiO_2 layer of Chambers is not formed by sputtering. The method employed in Chambers (OPA-MBE) is completely different from sputtering and involves high substrate temperatures, e.g., from 300 to 750° C. *See* Chambers, page 3467. MBE is an epitaxial method in which the coating and the substrate have the same

cristallographic lattice. By contrast, sputtering methods can be employed to form anatase coatings directly on amorphous glass by simply heating the substrate. The methods of are so disparate that a skilled artisan would not reasonably expect that substrates that are employed in the method of Chambers (high-temperature epitaxial method) would have any usefulness in the method employed in the method of Takahashi (room temperature sputtering method). *See, e.g.*, MPEP §2143.02 (citing *In re Merck & Co., Inc.*, 800 F.2d 1091 (Fed. Cir. 1986)) (*prima facie* case of obviousness based on proposed modification to reference will only stand if one of ordinary skill would have had reasonable expectation of success upon making the modification).

Moreover, Takahashi is directed to formation of photocatalytic bilayers. On the other hand, Chambers is related to the ferromagnetic properties of anatase cobalt-doped TiO_2 layers. The Office Action simply fails to articulate a reason why one of ordinary skill in the art would have expected that features of the structures of Chambers would have any utility in the structures of Takahashi. The only apparent reason to combine the disparate teachings of Takahashi and Chambers is found in the present specification. *See, e.g., Ex parte Whalen*, 89 USPQ2d 1078, 1084 (Bd. Pat. App. & Int. 2008) ("[t]he *KSR* Court noted that obviousness cannot be proven merely by showing that the elements of a claimed device were known in the prior art; it must be shown that those of ordinary skill in the art would have had some 'apparent reason to combine the known elements in the fashion claimed'").

Zeman, Zhang and Doushita do not remedy the deficiencies of Takahashi. Zeman is cited for its alleged disclosure of employing magnetron sputtering to form titanium oxide films. *See* Office Action, page 4. Zhang is cited for its alleged disclosure of doping a titanium oxide film with iron. *See* Office Action, pages 4 to 5. Doushita is cited for its alleged disclosure of forming a anti-soiling titanium oxide layer over a glass substrate having an alkali-blocking film *See* Office Action, page 5. However, like Takahashi and Chambers,

none of Zeman, Zhang and Doushita discloses or suggests a structure including a substrate, an underlayer that assists in heteroepitaxial growth of anatase TiO_2, and a TiO_2-based layer. Accordingly the combination of references fails to disclose or suggest each and every feature of claim 1.

Further, as mentioned above, it is possible to obtain anatase TiO_2 by heating during deposition. Such techniques are generally employed in small-scale laboratory settings, because such techniques generally require very long deposition times and long exposures to plasma to heat the substrate. As a result, it is not possible to obtain anatase TiO_2 by heating during deposition in industrial settings where high deposition speeds are required. Zeman discloses a technique in which anatase TiO_2 is formed, in which the substrate is heated to approximately to 200 to 250 °C by application of a plasma over a long period of time. Zhang likewise discloses a technique in which anatase TiO_2 is formed employing very long deposition times (i.e., 5 hours – *see* page 334, right column) – it is plain from the disclosure of Zhang that heating of the substrate results in formation of anatase TiO_2. One of ordinary skill in the art would not have reasonably expected that any aspect of, e.g., the methods of Zeman and Zhang, which employ heat to form anatase layers, would be applicable to a method as in Takahashi, in which heat is not employed. Further, one of ordinary skill in the art would not have expected that the methods of Zeman and Zhang could be modified to be adapted to an industrial scale, as in the case of exemplary methods used to obtain the structure of claim 1. Thus, one of ordinary skill in the art would not have combined the teachings of the respective references as proposed in the Office Action.

For the reasons discussed above, the cited references, either alone or in combination, fail to disclose or suggest a structure including a substrate, an underlayer that assists in heteroepitaxial growth of anatase TiO_2, and a TiO_2-based layer. Accordingly the combination of references fails to disclose or suggest each and every feature of claim 1.

As explained, claim 1 would not have been rendered obvious by Takahashi, Chambers, Zeman, Zhang and Doushita. Claims 2-13 and 20 depend from claim 1 and, thus, also would not have been rendered obvious by Takahashi, Chambers, Zeman, Zhang and Doushita. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

B. Chambers, Zhang and Doushita

The Office Action rejects claims 1-13 and 20 under 35 U.S.C. §103(a) over Chambers in view of Zhang and Doushita. Applicants respectfully traverse the rejection.

Claim 1 is set forth above. Chambers, Zhang and Doushita do not disclose or suggest such a structure.

Chambers, Zhang and Doushita do not disclose or suggest each and every feature of claim 1 for at least the reasons discussed above. Applicants would like to again emphasize that the $SrTiO_3$ layer in Chambers is not an underlayer, but a substrate – the structure of Chambers does not include a substrate, an underlayer and an anatase TiO_2-based layer, as required by claim 1. The proposed combination of features of Chambers, Zhang and Doushita thus does not correspond to the combination of features recited in claim 1.

As explained, claim 1 would not have been rendered obvious by Chambers, Zhang and Doushita. Claims 2-13 and 20 depend from claim 1 and, thus, also would not have been rendered obvious by Chambers, Zhang and Doushita. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

Conclusion

For the foregoing reasons, Applicants submit that claims 1-20 are in condition for allowance. Prompt reconsideration and allowance are respectfully requested.

Respectfully submitted,

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